

SCIENCE

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LIQUID OXYGEN.

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It is now fifteen years since Pictet and Cailletet first liquefied oxygen. Since then liquid oxygen has been the object of investigation by Olsewski, Wrobleaski, and more particularly by Dewar. At a lecture delivered at the Royal Institution in London, in June last, Dewar exhibited a litre of liquid oxygen in an open vessel; and he has prepared from time to time many litres of the liquid for the purpose of examining its properties. The method he uses is the same in principle as Pictet's, but he has much larger and better pumps for exhausting and compressing the gases. The essential thing is to cool the oxygen well below its critical temperature, or absolute boiling point, -119° C. This is effected by means of some other gas, such as ethylene, which has a much higher critical temperature, namely $+10^{\circ}$ C., and still a very low boiling point under atmospheric pressure, namely -103° . Nitrous oxide, which has a critical temperature of $+53^{\circ}$ C., and boils under atmospheric pressure at -93° C., may also be employed. If the liquid ethylene be first cooled to -80° C. by immersion in a mixture of solid carbonic acid and ether, it can then be easily reduced to -103° by allowing it to evaporate at the pressure of the air; and by pumping away the vapor as fast as formed the temperature of the remaining liquid can be reduced as low as -140° , twenty-one degrees below the critical temperature of oxygen. At this temperature oxygen is liquid if condensed until its pressure is equal to 30 atmospheres or thereabouts. On removing the pressure the liquid boils and is cooled by its own evaporation until under a pressure of one atmosphere it falls to -183° C. By pumping away the gas as it is formed, the temperature is easily reduced to -200° C., and the liquid then remains quite tranquil, and has the appearance of so much water.

Air may be liquefied in the same way, but the boiling point of nitrogen is somewhat lower than that of oxygen, namely -193° C., so that when liquid air is allowed to boil away gradually, the residue becomes richer and richer in oxygen until nearly pure liquid oxygen is left.

The compressed oxygen met with in commerce always contains a little air and some carbonic acid, and both pass into the liquid oxygen. The carbonic acid crystallizes out in the solid state and renders the liquid milky. It may, however, be filtered through paper, and is then perfectly limpid.

To prevent the rapid deposition of hoar frost on the vessel containing the cold liquid, it has to be protected by an outward vessel, and the intervening space well dried. A beaker glass may be fitted with a varnished wooden cover and a smaller beaker to contain the liquid inserted through a hole in the cover, the space between the two being dried by a layer of phosphoric anhydride.

Oxygen does not show any increased chemical activity in consequence of liquefaction. As already mentioned it may be filtered through paper without affecting the paper. It is powerfully magnetic. Poured into a saucer of rock salt it at once assumes the spheroidal state, exaporating from its surface, but quite tranquil. If now it be brought near the pole of an electro-magnet, it will jump up, through half an inch or more, and adhere to the pole, looking like a blob of transparent ice. Of course it is not really solid, and as soon as the current of the electro-magnet is broken it falls down. Like iron it is attracted by either pole indifferently.

As it is the only transparent element which is magnetic, its behavior to light is of great interest with reference to the electro-

magnetic theory of light. According to that theory it would be expected that light reflected from a plane surface of a transparent magnetic body, when the reflected and transmitted rays are at right angles, would not be polarized in the plane of incidence as it is when the reflecting body is diamagnetic. Dewar has found, however, that light incident at the proper angle and reflected by liquid oxygen at -200° C. is very completely polarized in the plane of incidence.

Seen by transmitted light liquid oxygen, in a thickness of three or more inches, has a faint, but decided, blue tint. On examining the transmitted light through a prism, the cause is plain. There are several absorption bands, of which the strongest is in the yellow. These bands, as observed by Olsewski, and by Liveing and Dewar who extended their observations into the ultra-violet, are identical in position with, but much darker than, the diffuse bands produced by oxygen gas. They coincide with certain diffuse dark bands noticed by Brewster in the solar spectrum, and ascribed by him to atmospheric absorption because they were stronger when the sun was near the horizon than when he was high in the sky. The persistence of these bands indicates continuity in the physical state of oxygen when passing from the gaseous to the liquid state.

It was observed by Jannsen, and Liveing and Dewar's observations tend to the same conclusion, that the intensity of these diffuse bands, for a given thickness of the gas, increases as the square of the density. On the kinetic theory such a result would follow if the molecules of oxygen absorb the corresponding rays when they are under the influence of other molecules but not when in free path. For both the number of the molecules in a given thickness, and the frequency of their collisions, increase directly as the density.

Furthermore, oxygen gas produces, besides these diffuse bands, certain absorptions consisting of rhythmical groups of fine lines. These, in the solar spectrum, are known as *A*, *B*, and α ; and it was Egoroff who identified these lines with the absorptions of oxygen gas. Their intensities appear to increase directly as the density, and may therefore fairly be ascribed to the action of the free molecules of oxygen gas. What becomes of these absorptions when the gas is liquefied? Olsewski, looking through 30 millimeters of the liquid, observed an absorption at the place of *A*. Liveing and Dewar, looking through six inches of the liquid, saw absorptions corresponding to both *A* and *B*, but somewhat different from those due to the gas. As produced by the gas, *A* is a group of lines which are very close together on the less refrangible side and are set farther and farther apart as they get more refrangible; so that the group when seen with low dispersion has the appearance of a shaded band with a strong, sharp edge on the less refrangible side, gradually fading away on the more refrangible side. *B* is on the blue side of *A*, and is precisely similar to it, but not so intense. α is still more refrangible, and still weaker. The absorption of the liquid at the place of *A* is also a shaded band, but its shading is turned the other way. Its sharp and strongest edge is on its more refrangible side, and it fades away on the less refrangible side. The strong edge does not correspond exactly with the strong edge of *A*, but is a little more refrangible, though still falling within the group. The band of the liquid could not be resolved, like *A*, into lines. The band corresponding to *B* is precisely similar, but fainter. It overlaps *B*, and has its strong edge a little more refrangible than that of *B*. It seems that we have in these bands the absorptions due to the individual molecules of oxygen, only modified in the way described by the change from gas to liquid; and we should infer that the molecules of the liquid are still the same as those of the gas.

There is more difficulty in determining the physical characters of oxygen than the facility with which it can be manipulated

would lead one to expect. It is especially difficult to find suitable vessels for it. Thin glass in one piece, like test-tubes and beakers, does very well, but thick glass and all kinds of cement are mostly cracked by cooling; and massive vessels involve the waste of a large volume of the liquid in the process of cooling them down to -180°C . With some trouble, however, Liveing and Dewar have succeeded in measuring the refractive index of liquid oxygen, at its boiling point, for the *D* ray of sodium. They used a hollow prism with glass faces clamped together and made tight at the joints with glycerine. The refractive index so found was 1.2236, somewhat less than that of water in the liquid state, which, near its boiling point, is about 1.32.

The density of oxygen at -182° is 1.124. These figures give for the refraction constant, $\frac{\mu^2 - 1}{(\mu^2 + 2)d} = .1265$, and for the corresponding refraction equivalent 2.024 . The mean values of the constant and equivalent as found by Mascart and Lorenz for gaseous oxygen are the same as those here given for the liquid.

Ozone is more easily liquefied than ordinary oxygen, but is formed with a storage of energy, and in a concentrated state is very explosive. When oxygen, ozonized in a Siemens' tube cooled with solid carbonic acid and ether, is passed into liquid oxygen, the ozone is dissolved and imparts a deep-blue color to the liquid. The boiling point of oxygen is lower than that of ozone, so that, as the oxygen evaporates, the strength of the solution and the depth of its color increase. The last drop has a steel-blue color, and explodes spontaneously with violence. If a glass tube conveying ozonized oxygen be cooled down to -180°C , or nearly so, the liquid ozone may be seen condensing on the sides and running down. It has been found impossible to collect the liquid, however, for no sooner have two or three small drops run together than they explode, shattering the vessel.

It is certainly remarkable that a substance which, unlike many substances which are formed with a storage of energy, is so unstable at high temperatures, should also be very unstable at low temperatures. Perhaps its instability may be connected with its powerful absorption of light, which is put in evidence by its deep color. What the form may be in which its excessive energy is stored, we can at present only guess at. Can it be that the three atoms, of which its molecule consists, rotate with great velocity about their common centre of mass in exceeding close proximity, and that a small impulse from without increasing the velocity as well as the distance of the atoms suffices to send them off in hyperbolic orbits to scatter destruction amongst the other molecules which they encounter? This might be the case if the velocity of the atoms greatly exceeds the velocity of agitation of the molecules on which the temperature depends.

NEW DISCOVERIES AT BAOUSSÉ ROUSSÉ, NEAR MENTONE.

BY THE MARQUIS DE NADAILLAY.

I KNOW of no discovery touching pre-historic times more remarkable than those made in the caves of Baoussé Roussé, between Mentone and Ventimiglia, on the borders of France and Italy. These caves were first discovered in 1872 by Mr. Rivière. Since that time this learned gentleman has vigorously prosecuted his excavations,¹ and they have yielded numerous human skeletons, all belonging to the celebrated Cro-Magnon race, who at the end of the quaternary period, or perhaps at the beginning of neolithic times, ruled not only the south of France, but also all the Mediterranean shores. It is these same men we meet with under the names of Iberians, Ligurians, Sicanians, perhaps also under those of Pelasgians and Berbers. It is their bones that the brothers Siret found in the south of Spain, Professor Sergi in Italy, and Mr. Rivière at Baoussé Roussé.

All the bones, wherever found, show a great similitude. They are robust, and bespeak an athletic constitution and a large muscular power. The men were remarkably tall, the crania are dolichocephalic, the tibiae platynemic, but since Dr. Manouvrier's

¹ They are related at length in "L'Antiquité de l'homme dans les Alpes maritimes." Paris, I. B. Baillière et fils, 1887.

observations,² we cannot see there an inferior character. The cranium of the first skeleton found (an old man) measured 1,590 cubic centimeters. The cranium of the woman found next to him 1,450 cubic centimeters; but this last measurement is not quite accurate, on account of the decomposed state of the bones.

The man had upon his head a net of small shells (*Nassa neritea*), and bracelets of shells round his arms and legs. Near him Mr. Rivière collected more than 150 stone implements, and also numerous bones of mammals, birds, and fishes, evidently the food of these people.

New discoveries quickly followed the first ones, and we always find a particular mode of inhumation, which, I believe, still exists, or lately existed, in some Indian tribes. The bones of all the adults, after the total decomposition of the flesh, were painted in red with the help of peroxide of manganese or other substances frequently met with in the different caverns.

The last excavations took place in February, 1892, in one of these caves, named Barma Grande. A communication made to the Académie des Inscriptions, March 4, 1892, informed us of the discovery, at 8 metres below the level of the ground, of three new skeletons, a man, a woman, and a young subject whose *dentes sapientiæ* had not yet evolved. They had been buried on a bed of cinders, broken fragments of charcoal, remains of all sorts, evidently the hearth on which the family cooked their victuals. The boy wore a necklace formed of two rows of the vertebrae of a fish and one row of small shells. At different points hung pendants cut out of the canine teeth of stags, decorated with parallel striæ. The man had also a necklace of fourteen canines of the stag, also striated. With the skeletons were found a certain number of stone instruments, some of them finely worked, but none of them polished, and some bone implements of very gross fabrication.

The man was very tall, and, if we judge by the length of the thigh-bone (545 millimeters), his height must have exceeded two metres³ (6 feet 6 inches). The boy, who had not yet attained his manhood, measured 1.63 metres (5 feet 8 inches). We must also remark the extreme wear of the teeth, very apparent already in the boy, and which in the man extended to their very root. I have already said that the caves of Baoussé Roussé yielded numerous bones of mammals, but none of them belonged to the extinct species, not even to the reindeer which is found in the south of France even at a late period. On the other hand, no polished stone implement was ever found in these caves. We can therefore give these men a pretty accurate date, and place their existence, as I have said, at the end of the quaternary or the beginning of the neolithic times. One cave remains as yet unexcavated. It belongs to the Prince of Monaco. Orders are given that the excavations shall begin next spring. If they produce anything of interest, I will not fail to report them to the readers of *Science*.

Rougemont, Sept. 2.

THE PREVENTION OF CHOLERA ASIATICA.

BY HUGH HAMILTON, M.S.C., M.D.

THE symptoms of cholera are so well known that it is a matter of common knowledge; however, to make the subject plain, it is very similar to *Cholera Morbus*, well known to every American, which is due to indigestion and disorder from the eating of improper fruits or too large amounts of perfect raw fruit. In *Cholera Asiatica* there is vomiting, purging, chill, sweat, death in a longer or shorter period. When *Cholera Asiatica* is epidemic, many of these lesser complaints of the digestive apparatus pass under its name, and, as a consequence, many remedies seem to cure the disease, which in fact is probably not *Cholera Asiatica* but *Cholera Morbus*, which is bad enough.

² Dr. Manouvrier has shown that platynemia is produced by long and hard work continuously acting on the muscles of the leg. It is found to a large extent in hard walkers, in populations living near the mountains. It is more frequent in men than in women; and it very rarely, if ever, exists in children.

³ The state of the bones precluded any accurate measurement, and comparison, when we reach these extreme heights, is very difficult. The Museum of Paris possesses the skeleton of a giant who measured 2.14 metres, and whose thigh-bone measured 563 millimeters.

But to the science of the subject. The cause of *Cholera Asiatica* is the bacteria, or vegetable fungus, found in the body of those dead from the disease and in the ejections and dejections of those afflicted with it. These bacteria belong under the head of those peculiarly fatal to mankind. It assumes the shape of a comma, i.e. (,), or an S-shape. It belongs in the class *Spirillæ*, i.e., S-shaped, but has been described by Professor Koch as *Komma bacillus*.¹ Now this *comma bacillus* is found in the intestines of fresh cholera-corpses and in the dejections of those ill with the plague. This being the source of the disease, although not its origin, we readily see that we must study its habits of propagation; its physical characteristics upon certain *organic* matter; its behavior on *living* material. Then we can scientifically regard its prevention.

It grows quickly upon a surface of gelatinous substances, and renders it after a while fluid. Looked at by a strong glass, capable of magnifying it 100 diameters, it looks like a funnel-shaped ring curled upon itself at the edges, if the gelatine or glue has been stuck with a needle.² Upon the smooth surface of gelatine it has a rosy shimmer. It requires a heat of the human body to grow, that is, 98.5° F. (37½° C.), so that it will not propagate at ordinary temperatures of the room. It grows on potato parings and pieces of bloody meat at 30° to 40° C. (86° to 104° F.), at 16° C. (61° F.) it ceases to grow, at 10° C. (50° F.) it exists, i.e., is not killed completely.³ Just here the nature of heat and cold may be noticed. Cold, agreeably with most vegetable seeds or spores, merely places them in a state of non-germination, particularly if dry; instances are easily brought to one's mind in a crude way by the vitality of the wheat, barley, rice, etc., exposed to excessive cold, while in a congenial temperature and moisture they grow. Heat, however, when applied to the boiling point, destroys all germination; because it is a rapid method of degeneration. Further, this *comma bacillus* is *aerobic*, i.e., requires air or oxygen from the atmosphere to live. The bacilli are divided into classes that are *ana-aerobic*, *semi-ana-aerobic* (?), and *aerobic*, meaning without atmospheric oxygen; sometimes requiring oxygen and sometimes not free oxygen; the last as we have above stated.

The method of discovering this *comma bacillus* in the dejections next engages one's attention. It is easily cultivated under aseptic conditions upon a gelatine surface exhibiting the characteristics spoken of above. It is colored by the method known to all bacteriologists, that of Professor Gram.

Solution No. 1, *a*, watery solution of aniline oil; *b*, saturated alcoholic solution of Gentian violet. *a* is made as follows:—

Aniline oil, one (1) part;
Distilled water, twenty (20) parts.

Filter. To the clear filtrate (it must be shaken and filtered until clear) add 5 parts of the *b*, i.e., saturated alcoholic solution of pure Gentian violet, to 100 parts of *a*, aniline water, made above.

After drying on a little piece of glass, the dejecta of a patient sick with *Cholera Asiatica* spread very thin, and then immersing it in the solutions, mixed as above, for three (3) minutes, and then for three (3) minutes more in a solution, 2, made as follows:—

Iodine, one (1) part.	} solution
Iodide of Potassa, two (2) parts,	
Distilled water, three hundred (300) parts.	

until all color seems to disappear; then dry the little glass and view under a microscope to 1,000 diameters; the *comma bacillus* will be larger than an ordinary comma (,).

When we really find this *comma bacillus*, then the patient has the epidemic cholera. Upon this fact is founded all the advance in our treatment of it. Here the scientific value of hygienic and sanitary regulations becomes apparent. Pardon me just here for referring to the recent work of Professor L. Brieger, the president of the Medical Section of the Imperial Institute for Infectious Diseases at Berlin, Germany, upon the immunity from the fatal effects of *Cholera Asiatica* which he has been able to produce in Guinea-pigs. The microbes of cholera, technically *cultures*, were

raised on agar-agar gelatine, put into peptonized meat-broth, and kept upon ice several days, then injected into the Guinea-pigs, about four cubic centimeters, for five or six days successively, when they could withstand the cholera cultures which, when given to other *unprotected* Guinea-pigs, quickly produced death.⁴ Of course, this immunity of the mammal, Guinea-pig, presents a vista of relief by protection similar to that given to us by vaccination from small-pox, and promised by "Koch's tuberculin" in the treatment of consumption (Tubercular Phthisis). We look forward to that day of *scientific* medicine.

The careful, methodical German has been directed by his imperial officers to be very careful in personal hygiene and to observe to the letter the regulations in the case of those sick from *Cholera Asiatica*, while the doctors have been compelled to carefully examine each case by the methods above given, and, if unable to do so, to send some of the diarrhoeal fluids to the district police stations to be examined at once at government expense—so careful are they to determine what the disease really is. Then the patient must be isolated, his nurses rendered strictly *a-septic* before being allowed to leave the apartments, all the attendants to be washed in solution of carbolic acid twice daily, and the patient too. No eating, drinking, smoking, or anything in contact with the mucous intestinal tract, such as mouth or nose, allowed in anyone except under strict *anti-sepsis*.

By this means it has been possible to prevent the spread of the disease to another case, if *discovered in time*. This element of *unwell*, but not *ill*, persons with *Cholera Asiatica* is the problem; the half-sick ones damage to the utmost hygienic arrangements, and bring disgrace on the attempts of "State" medicine to prevent its spread. This brings one to the application in a more extended sense of isolation or detention in quarantine of numbers of people. This is a troublesome problem to successfully solve; it is now taxing all the wit and wisdom of our land. We trust it may be successful.

⁵ The best disinfectants are:—

1. Lime-water; a quantity equal to the amount of the stool and allowed to cover and remain upon it one hour.
2. Chloride of lime (small boxes); two tablespoonfuls on each stool and allow to remain on it twenty minutes before cleansing the utensils, then washed with lime-water.
3. A soft soap of potash, mixed with 5 per cent of crude carbolic acid solution. This to be used for all vessels, clothes, clothing, both body and bed.
4. A one per cent solution of carbolic acid for bodily bathing of patient and nurses.
5. Daily scrubbing the floor and furniture with lime-water, and two hours afterward with a one per cent carbolic acid solution in the patient's room.
6. A boiling of an hour of all clothing.
7. All the shoes, effects, etc., in the room of a patient either afflicted or dead from *Cholera Asiatica* shall be disinfected and not used for ten days.

The conclusion of the matter is:—

Live carefully; keep away from those afflicted with the disease, except specially protected as aforesaid; keep clean; isolate the patient and his attendants.

Harrisburg, Penn., Sept 13.

FLORIDA PITCHER PLANT.

BY CHARLES B. PALMER, A.M., COLUMBUS, OHIO.

AMONG the many curious and interesting objects which came under my notice during a residence of several years in Florida, none interested me more than an insectivorous plant (*Saracenia variolaris*) which is common about Orange Heights, in eastern Alachua County. I have no reason to suppose that it is limited to this locality, but this is the only place in which I have observed it. It is a modest plant, seven or eight inches in height, growing in damp situations among the coarse grass of the pine woods.

It bears a single radical flower, the most striking feature of which is the style, which expands into a broad umbrella, entirely enclosing the flower. But it is not of the flower, but of the pitcher-like leaf that I wish to speak.

¹ Berl. Klin. Wochenschr., 1884, Nos. 31, 32, and 32a.

² Dr. Carl Gunther's Bakteriol: Leipzig, 1890. Pl. viii., Fig. 47.

³ Bakteriol: Diagnos: Eisenberg, Hamburg, 1891, p. 256.

⁴ Deutsch. Med. Wochenschr., 1892, No. 31 (Aug. 4, 1892).

⁵ Regulations of Minister of Interior, Germany, Aug. 1, 1892.

When the young leaf first makes its appearance, it is spatulate in form, with a simple notch on one side near the end, ranging upward at an angle of about 45 degrees. As the plant grows, the sides separate, forming a tube, while the notch increases in size and rotates in direction, until it becomes an ample opening ranging downward at an angle of about 45 degrees. At the same time the end of the spatula enlarges into a dome-shaped hood, the upper lip at the opening projecting well forward and downward over the lower. The tube is largest at the top, narrowing gradually to a point a short distance above the ground. The front or open side of the tube has a narrow rib, the rest of the circumference being round and smooth.

Being unable to find in botanical literature any adequate account of the manner in which this plant performs its remarkable functions of catching and devouring insects, I was led to make the study myself. Placing several of the plants in flower-pots for continuous observation, dissecting numbers of others in the woods almost daily, and continuing these observations during several different seasons, the little pitcher has come to seem like a familiar friend, and has yielded me an amount of pleasure and satisfaction that would seem incredible to any but a lover of nature.

If one were to say that he had seen a tree which could catch and eat squirrels, rabbits, field-mice, etc., he would be set down as a bungling imitator of the celebrated Baron; but here is a frail plant which we tread upon unnoticed, that actually captures, devours, and digests number of animals endowed with much greater activity, and doubtless with higher powers of perception, than any mammals.

If the plant has any odor attractive to insects it is not perceptible to human olfactories. But when near the opening they seem possessed with a desire to enter, and the way is open and easy. At the edge of the opening they are seen to sip a secretion of the plant, and immediately hasten on to the interior. Here some of them will continue to eat ravenously until they are seized with a sort of palsy, causing them to tremble violently, release their hold, and fall into the liquid at the bottom of the tube. Others, after entering the dome, become frightened and endeavor to escape. And here is discovered one of the remarkable features of the plant — an arrangement clearly intended to deceive the unlucky prisoner. The hood projecting over the opening forms a dark background, while the opposite side of the dome is brilliantly lighted by means of more than a hundred transparent spots or windows. Just as a bird which has entered a room by a dark passage, beats against the window-pane, so the poor insect exhausts his strength at the windows of his prison, and finally falls exhausted — literally “in the soup.”

The bath seems to cure their palsy, for they invariably struggle vigorously to escape by climbing up the side of the tube. But the effort is vain. It seems remarkable that insects which walk upon glass and other smooth surfaces at will can make no progress here. The inner surface of the tube has a wonderfully smooth feel, and under the microscope is seen to be covered with very fine hairs forming a nap in the downward direction. About half-way up the tube there is a change in the appearance. It looks as if the lower part were wet and the upper dry, but the microscope shows that the appearance is caused by a different arrangement of the hairs on the surface. On the upper half, they appear like bundles of grain with the ends well spread. The purpose of this arrangement is not apparent; but having on one occasion found a larva at the half-way point, it occurred to me that possibly certain species had feet able to traverse the lower half, and such would be stopped by the different arrangement above. However this may be, the insect which once enters this doubly and trebly guarded prison “leaves hope behind.” Even when rescued, he seems unable to resist the temptation to taste again the insidious nectar which leads him to his doom. Cut away the hood, and let a blade of grass down into the tube. A half-dead fly climbs eagerly out. Too weak to fly, he can be handled at will. Place him on the outside of the tube, an inch or more from the opening, with head turned away from danger. He staggers forward a few steps, stops and considers, then like the confirmed toper in front of a saloon, turns around and goes

back for one more drink. At the first taste, he becomes crazed, sips ravenously till the tremens comes on, and drops him down to certain death.

The number and variety of insects disposed of by a single plant is astonishing. Every order is represented. One would think that a grasshopper, large enough to reach across the tube and almost close it up with his body and long legs, would have small excuse for being in such a place. But there he is slowly dissolving. Beetles, moths, larvæ of numerous kinds, including large woolly caterpillars, all go the same way. The hymenoptera are represented by ants, but I have never found any species of bee, though I have searched diligently for that special purpose.

The statements of certain botanists that the pitchers are “half filled with water containing drowned insects,” and that “it is difficult to believe that they have any connection with the economy of the plant,” need revising. A chemical analysis of the fluid is wanting, but it is a secretion of the plant and not rain-water. The construction of the plant makes it impossible for rain to enter. Furthermore, I have seen a plant which had been cut off at the root send up a new leaf, mature its pitcher, secrete its fluid, and begin business, during a period in which no rain had fallen.

In every healthy pitcher may be found insects still alive and struggling; others dead; others farther down in the mass, coarsely broken up; and at the bottom only a pulp. The fact that the elytra, mandibles, and other hard parts of beetles, are dissolved with the rest, shows that the plant has remarkable digestive powers. Unlike animals, it has no means of rejecting unsuitable portions of food. Everything goes. The front door is always open, there is no back door, all sorts of visitors enter, none escape, every shred disappears.

CURRENT NOTES ON ANTHROPOLOGY.—XV.

[Edited by D. G. Brinton, M.D., LL.D.]

The Antiquities of Catamarca.

AMONG the mysterious civilizations of the New World which were extinguished before the arrival of the Europeans, that of the Province of Catamarca, in north-western Buenos Ayres, is not the least difficult of solution. In this region, over an area about four hundred miles square, the vestiges of a dense population are numerous, and there are abundant proofs that there prevailed a stage of culture definitely above that of the Pueblo dwellers of New Mexico. The ruins of stone-built structures are abundant, and are the only instances of such that we find east of the Andes in the whole of South America. They begin at a height of twelve to fifteen thousand feet, and continue down to the mesas and plains of the lowlands. From their positions and plans most of them were evidently defensive works, occupying points of vantage, and with walls three to five feet in thickness. The entrances are concealed or sometimes none exist, ladders having evidently been used by the inhabitants. They were acquainted with the use of copper, gold, and silver, made excellent pottery, wove fabrics with skill, cultivated maize extensively, and buried in mounds.

An interesting but brief notice of these remains is published by Francisco P. Moreno in the “*Revista del Museo de La Plata*,” 1891. He considers the remains are anterior to the conquest of the country by the Incas about 1450. This is probable, but it would not militate against the evidence I have brought forward in my “*Studies of South American Languages*,” p. 54, that the natives of Catamarca were themselves of the same blood and language as the Incas.

Central-American Languages.

The Empress Catherine II. of Russia at one time planned publishing specimens of every language on the face of the globe, but lost interest in her scheme, and dropped it before completion. When at St. Petersburg a year ago, I inquired about the material collected by her orders, but left unpublished. The Librarian of the Imperial Library could give me no information about it.

Now, part of it arrives in a publication from Costa Rica entitled “*Lenguas Indigenas de Centro-America en el Siglo XVIII. MS. del Archivo de Sevilla. Publicada por R. F. Guardia y Juan Fernandez Ferraz. 1892.*” The editors do not state, and do not

seem to be aware, why these twenty-one vocabularies were collected by a priest in 1788; but I have no hesitation in attributing them to the desire to comply with the wishes of the empress of the Russias, and am sure it could be readily shown.

Their publication is praiseworthy, and carefully made; but it does not offer any new material on Central-American dialects in the sense of new stocks. Two of the Maya dialects, the so-called Populucan and Subinhan, are slightly different from those already known; and the language termed "Lean y Mulia" is the same as what we know from other sources under the more appropriate name Xicahque. The vocabularies include the Chapanec of Chiapas and several Costa Rican dialects, though the majority are branches of the Maya family.

An Anatomical Criterion to Distinguish Male from Female Skulls.

It has long been most earnestly desired to discover some anatomical feature which would enable us to distinguish the skulls of the sexes. Two years ago Virchow declared that all alleged modes of differentiation so far discovered were worthless. Very lately Dr. Thiem-Cottbus, in the "Archiv für Klinische Chirurgie," Band 37, describes what seems a satisfactory craniological criterion of sex.

The os tympanicum forms part of the posterior wall of the glenoid cavity of the inferior maxillary, and also closes in front and below the bony meatus of the ear. It arises perpendicularly from the petrous portion of the temporal bone posteriorly, and turns backward, in the woman at about half the height of the mastoid process, but in man at a less height. In the male, the bone develops a sharp edge, which divides to form the sheath of the styloid process; but in woman this sharpened edge does not exist, the bone is rounded into a tubercular form, and the fossa is shallower and flatter.

Thus, in the male this fossa-tympanico-stylo-mastoidea is small, and the posterior wall of the glenoid cavity extends so deep that it is not possible for the condyloid process to slip over it. In the female, it is so much more spacious that this feature alone will serve to distinguish the crania of one sex from the other; and it also explains the surgical fact that luxation backward of the inferior maxillary is observed only in women.

An Etruscan Ritual Book.

Before Rome was founded, the powerful federation of the Etruscans had spread an advanced civilization over central Italy, capping her hill-tops with fortifications, whose impregnable walls still bid defiance to time. But by the beginning of our era, the Etruscan people, and language and religion, had disappeared, leaving no testimony but their tombs. From these some five thousand inscriptions have been copied, but they tell us little. Not a single word of the language has been identified beyond peradventure.

The Etruscan religion profoundly modified that of Rome. They were a literary people, and in very early times wrote numerous religious books. These are referred to by Livy as works of divination, *fatales libri*, and by Cicero as books of ritual, *Etruscorum rituales libri*, or as Etruscan documents, *chartæ Etruscae*; and even in the latter's day, they were in use by the Roman priesthood.

It seems an incredible piece of good fortune that one such Etruscan Ritual Book should turn up in fair preservation in the year 1891; but such seems to be the case. Two or three centuries, B.C., a mummifier of Alexandria bought a lot of waste paper and old rags for use in his business, and employed some of it in wrapping the corpse of a young lady. About 1849 her mummy was brought to Austria, and last year in her wrappings this Etruscan book was identified by Professor Krall. The Vienna Academy of Sciences has undertaken its publication, and on its appearance I shall return again to its curious history and character.

Ethnography of the Finns.

One of the most interesting questions in the ethnic history of the north of Europe is that concerned with the origin and migra-

tion of the Finns. They are ancient settlers, as they were known to the Romans of the time of Tacitus as dwellers on the Baltic Sea. In language they are first cousins of the Magyars of Hungary and also of the Samoyeds of Siberia. Indeed, some maintain that their name "Suomi" is from the same radical as "Samoyed."

Those resident in Finland proper rarely show any marked Mongolian appearance, as I can say from personal observation; but their strain is deeply Aryanized. A much less familiar branch of them are the Sirieni or Syränen, who dwell in north-eastern Russia, on both slopes of the Ural Mountains, extending east to the valley of the river Ob, on which the town of Muji is one of their principal resorts, in latitude 65° north.

This group has been carefully studied by M. Stephen Sommier, whose volume, "Sirieni, Ostiacchi e Samoiedi dell'Ob," appeared a few years ago in Florence. From numerous anthropometrical measurements he carried out, he satisfactorily showed that the Sirieni are Germanized Finns, quite like their relatives on the Baltic, and differing widely from the Ostiaks and Voguls to the east. It is probable, indeed, that the Sirieni, who are much given to trading and wandering, are an offshoot of the western branch of the stock, rather than the eastern.

NOTES AND NEWS.

THE sixth annual convention of the Association of American Agricultural Colleges and Experiment Stations will meet in New Orleans, La., on Nov. 15, as announced by the chairman of the executive committee. Titles of papers should be sent to C. F. Atkinson, Auburn, Ala., before Oct. 1. It is proposed to discuss the different subjects assigned to station workers for the Columbian exhibition.

— A timely book is "The Career of Columbus," by Charles Elton, M.P., announced by the Cassell Publishing Company.

— Professor D. S. Margoliouth of Oxford has undertaken to translate the great Arabic geographical dictionary.

— G. P. Putnam's Sons are about to publish a new edition of Professor F. W. Taussig's "Tariff History," enlarged by about 100 pages of new matter, including a discussion of the McKinley Bill.

— Francis P. Harper will publish shortly a new and important edition of Lewis and Clarke's "Expedition over the Rocky Mountains," on which Dr. Elliott Coues has been engaged for some time. He is specially fitted for the task, and the index to this faithful reprint of the Philadelphia edition of 1814 will be of great scientific value.

— Harper & Brothers will soon publish an interesting work by Walter Besant, entitled "London," which will not be a history of the city as a body politic, but the story of the life of the people at different periods from the earliest historical records to the times of the Georges, and will be fully illustrated.

— Edward Stern & Co., Philadelphia, will publish at once "In Arctic Seas," by Dr. R. N. Keely, in which the author, who accompanied in the capacity of surgeon the West Greenland Expedition last summer, gives an account of the incidents of the voyage of the "Kite," conveying Lieutenant Peary's party to McCormick's Bay.

— On Sept. 1, *The Open Court* (Chicago, Ill.) began the publication of a series of articles by Mr. Charles S. Peirce, to be entitled "The Critic of Arguments." (The word *critic* here means an art, like *logic*.) This series will be devoted to a critical and historical discussion of the methods of reasoning. Mr. Charles S. Peirce is one of the most distinguished scholars and mathematicians of which America boasts. But especially in the department of modern logic has his work contributed, perhaps more than that of any other living investigator, to the permanent advancement of science. The results of his thought are, however, for the most part locked up in the proceedings and reports of learned societies, and now for the first time, in *The Open Court*, are they to be presented in a less rigid and technical form, and made accessible to all who place a value on right thinking.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

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ANCIENT MEXICAN HERALDRY.

BY AGNES CRANE.

THERE can be no more striking instance of separate evolutions on the same plane of thought in different grades of culture than the independent development of a system of heraldry, or "armory" as it should be rightly called, in the western hemisphere by the aborigines of ancient Mexico long anterior to the epoch of the Spanish Conquest in 1521. It was based, like the heraldic systems of Europe, on personal distinction in battle, which seems to have been originally the sole source of ennoblement among all people, and possessed the same intent to blazon forth personal exploits and record individual achievements.

It may seem a strange anomaly to refer to the "coat armour" of painted warriors not overburdened with clothing, adorned with labrets, nose-crescents of gold and other barbaric ornaments, whose personal prowess in warfare was exerted to capture their enemies alive in order that they might be offered as living sacrifices to the gods of the victor in the combat. Yet we have the authority of Logan, the historian of the "Scottish Gael," for the statement that so late as 1644 the Highlanders under Montrose fought divested of most of their clothing at the battle of Tippermuir. It is equally true that the war-shields and gala-shields of the ancient Mexican warriors were "charged," in many instances, with "animate designs" and various emblems recording the gallant deeds of arms, of the individuals who bore them, and the distinctions and "augmentations" granted them in recognition thereof by their so-called "emperor" or chief-priestly ruler. In others, again, they carried phonetic symbols rudely expressing the name and rank of the owner, like the "canting arms" or *armes parlantes* which formed the larger proportion of the early coats in European heraldry with as great an effect as the spear in the much discussed coat of Shakespeare, the padlocked heart of the Lockharts, the four emblazoned hands of the Quatermaines, the three cocks of Cockaigne, and the whelk shells of Shelley. A similar canting-shield was carried by the leader of the Tlaxcallan forces which accompanied Cortes on his way to Tetzco. It

is depicted in a native chronicle as exhibiting a monstrous face with eyes borne on the palms of severed hands and belongs evidently to the same category. The name of this Tlaxcallan ruler, Maxixcatl, is expressed in the same pictorial record by the hieroglyph of an eye on the palm of a hand, and the symbol for water which yields in the Aztec or Nahuatl language the elements *ma*, *ix*, *atl* from *maïtl*, hand; *ixtli*, eye; and *atl*, water. It is obvious that the elements *maix* are conveyed by the eyes on the palms of the severed hands on the shield to which we refer.

Much that is both interesting and suggestive on this subject will be found in the remarkable memoir "On Ancient Mexican Shields," from which this example is taken, contributed by Mrs. Zelia Nuttall, special assistant in Mexican archæology of the Peabody Museum of Cambridge, Massachusetts, to a recent issue of the "Internationales Archiv für Ethnographie," Vol. V., Part I., 1892. It gives full details with colored illustrations of the heraldic devices on war-shields and gala-shields borne in religious dances as figured in various native MSS. and Codices, described in the Spanish inventories, or depicted on ancient Mexican shields still preserved in the museums of Mexico City, Vienna, Stuttgart, London, and at Castle Ambras in the Tyrol. The supplemental accounts derived from native sources and old Spanish chronicles of the system of rewards granted by the chief ruler to successful Mexican braves in savage warfare are of special interest and value.

This system was, to say the least, peculiar. The neophyte went forth to battle clad in white raiment, with a blank shield. On capturing an enemy alive he was granted the privilege of painting his body yellow, his face red and his temples yellow, and the right to wear a colored uniform and a shield to match his war-paint. The Mexican war-shield was round, like the Highland Targe

"Whose brazen studs and tough bull hide
Had death so often dashed aside,"

and described by bards more ancient than Sir Walter Scott as painted red, spotted, varied, or chequered. In Old Mexico the capture of two foes was rewarded with a more elaborate costume, a gold *yacumetz* or nose-crescent and a shield decorated with feather pellets. The warrior who took three prisoners alive received a wooden shield with a border of blue, the royal color, or one displaying parti-colored stripes with a fringe attached to it. Further captures were rewarded with ornaments of gold, or precious stones, and the images of these quartered on the shields "in augmentation" record the nose-crescents and labrets won and worn by those who had performed such signal deeds of valor.¹ One shield bears four, and another ten of these designs which present some resemblance to the thirty-seven crescent-shaped ornaments of beaten gold adorning the magnificent feather headdress of the time of Montezuma described by Mrs. Nuttall in the first number of the first volume of "The Peabody Museum Papers." They recall, also, the buckles considered by recent authorities on European heraldry as a military badge, one of which is actually borne on the shield of the Pelhams, Earls of Chichester, to commemorate the ancestral share in the capture of King John of France at Poitiers. In the same manner a negro's head is quartered on the family shield of a "highly well-born" German family as a record that an ancestor took prisoner a black princess during one of the crusades.

¹ It would be interesting to know if the additional labrets and nose-crescents were quartered on the shield because of the personal inconvenience of wearing more than one of these distinctions.

Thus, simultaneously with the knights of old in Europe, the warriors of ancient Mexico "obtruded the blazon of their exploits on their company." Mrs. Nuttall gives the Aztec word *totopalitoo* as the equivalent of "to blazon forth or proclaim one's own praise," and states that the Nahuatl word for gala-shields was *totopchimalli*. It is further evident from her researches that the ancient Mexican shields proclaimed their owner's achievements as effectually as the "coat of seas strown with palm-clad isles" granted to the great navigator, Columbus, the towns with spires and belfries of the conquering Cortes, and the "augmentations" and "supporters" granted to the father and all the descendants of the African explorer, Captain John Speke — running water superinscribed "Nile," with a crocodile for crest, and a crocodile for dexter and hippopotamns as sinister supporters. As a modern example of recognition of noble achievements in the less adventurous paths of science we may cite the bizarre shield of Sir John Herschel emblazoned with the astronomical sign of the planet Uranus, "a forty-foot reflector," observer's house, and other paraphernalia. It may be added that the gruesome emblems portrayed on the shields borne by the chief-priestly warriors of the Aztecs were as significant of official functions as the mitre so often quartered in our episcopal arms.

Many of the heraldic emblems of the ancient Mexicans recall those of Europe — "the eagle's claw on an azure field borne by the sub-chiefs known as the "daring eagles," blue serpents on a red field, the tiger's leg shield the insignia of an order of chivalry carried only by the daring ocelotl or tigers a "crack corps" clad in ocelotl skins. There is the death's head shield of the "emperor" Tizoc, the allusive feather-pellet shield of the war-god, Huitzilopochtli, bearing reference to his mythical origin from a tuft of humming-birds' feathers; the shell on that of the hero-god, Quetzalcoatl, which reminds one of the three escallops quartered on the coat of Darwin. The cross, often quartered on the shield of Quetzalcoatl, was symbolical to the native mind of winds blowing from the four quarters of heaven. In Mexico, we are told, the gods were represented with emblematic shields. The rain-god, Tlaloc, with a water-lily on a green field, the death goddess with cross-bones on a red field. This is not altogether surprising for, in many instances, they were the deified chief-priests and supreme war-lords of bygone generations. In this connection we may recall the fact that coat-armor was assigned to the Saviour and the twenty six quarterings emblazoned on an escutcheon in Mayence cathedral, and also the coats "granted to ennoble" the disciples by European heralds. (1.)

There is Mr. H. H. Bancroft's authority for the statement that Montezuma bore into battle "a banner with the strange device" of an eagle with beak and claws of gold swallowing a serpent, on an azure field. This was perhaps the first instance of "spread eagleism" on the continent of America. It was emblematic of the myth concerning the foundation of the pueblo of Tenochtitlan in the valley of Mexico, and the design still forms the national arms of the modern republic of Mexico.

Animal designs are of frequent occurrence, and, like many of those employed by European heralds, are just as great a puzzle to the bewildered zoologist as the live lions at "the Zoo" to that sceptical official of the Herald's College who said he had "tricked" too many lions in his day not to know the real animal when he saw it. One of the most remarkable of the Mexican emblems is that of the blue monster outlined in strips of beaten gold, rampant on a rose-red field of

the beautiful feathers of the roseate spoon-bill (*Platalea ajaja*), the use of which was restricted to the decoration of idols and supreme rulers. This fine shield was rediscovered by Mrs. Zelia Nuttall last summer, preserved, with other objects, in a case labelled "Transatlantic and Oriental curiosities," in the castle of Ambras, near Innsbruck, in Tyrol, where it has found a home for the last three centuries. This historical shield has been clearly identified by her as that described in the Spanish Inventory of 1596, which formerly belonged to the Archduke Ferdinand of Tyrol, and as one of the shields presented by Cortes to the Emperor Charles V. It bears traces of the former existence of a fringe of the long tail-feathers of the Quetzal, the use of which was also restricted to supreme rulers in ancient Mexico. The device, which is accompanied by the native picture signs for fire and water, may represent either the blue ocelotl or the Ahuitzotl, a fabulous aquatic monster dreaded by the Mexicans. It bears a striking resemblance to the "heraldic wolf" of the twelfth and thirteenth centuries. The shield is certainly a gala-shield, and could only have been used by a war-chief of the highest rank. It is the best preserved example extant, and, to quote the exact words of our authority, is "the only one possessing a valid, if shadowy claim, to be that shield of Montezuma, which documentary evidence proves to have once formed part of the famous collection of historical armor of the Archduke Ferdinand, nephew of Charles the Fifth."

Another shield of wood, inlaid with turquoise and shell mosaic, was also found at Ambras. Since attention was called thereto by a communication addressed by Mrs. Nuttall to the Anthropological Society of Berlin (*Zeitschrift für Ethnologie*, 1891, p. 485), this valuable relic has been removed to the Imperial Ethnographical Museum of Vienna, which also contains the historical piece of ancient Mexican feather-work which Mrs. Nuttall has elsewhere shown to be a royal diadem or head-dress of the time of Montezuma, although it was originally described as a standard or banner by the late Professor F. von Hochstetter, who first recognized its value and ensured its preservation.

The centre or boss of a second specimen of an inlaid turquoise mosaic shield is exhibited in the Christy collection in the British Museum, where it is named, on what authority is not known, a Mexican calendar; but Mrs. Nuttall is enabled to state from personal examination that it is not a calendar, and bears none of the symbols of the Mexican year. In all, Mrs. Nuttall's industry and acumen have resulted in the accumulation of figures or descriptions of hundreds of Mexican shields from native and Spanish sources. Not more than six specimens are actually known to be preserved in the museums of the world. Her researches throw fresh light on the status of the ancient Mexicans and their somewhat bizarre semi-civilization.

Colonel Garrick Mallery, in his interesting work on "The Pictographs of the American Indians," reproduces native representations of North American Indian chieftains on the "War Path," carrying shields bearing the *totem* of the tribe, a very useful distinction when different tribes unite in raiding, as we know to be still the custom. We believe, however, that Mrs. Nuttall's memoir on "Ancient Mexican Shields" records the first evidence of heraldic emblems borne in the western hemisphere "as boastful records of individual achievements." We are not aware that any evidence has been discovered of the hereditary use of heraldic devices in ancient Mexico, although there are frequent references in her various and important publications to native

genealogies accompanied by portraits of *pilhua* = the heads or founders of large families as found recorded in native MSS. It is more probable that in a state of semi-barbarism individuals had to earn and win their own distinctions. No hereditary surnames were in use among the Mexicans anterior to the Spanish conquest. It is stated in a recent treatise on European Heraldry¹ that some of the peasants of the Jura Mountains did not possess them so late as the Election of 1789. We learn from the same authorities that surnames did not come into general use in Europe until after the second crusade of 1147, which gave such an impetus to the bearing of coat armor and heraldic insignia in general. In this regard it is interesting to note that it was to the intertribal wars waged in Mexico solely for the purpose of securing human victims for religious sacrifices that we can trace the development of Mexican heraldry. The independent invention and use of heraldic insignia in the New World is but another proof of the truth of the dictum that human nature is very much alike all the world over.

Brighton, England.

GAY HEAD.

BY P. R. UHLER.

THE steady flow of modern travel has opened an easy way to the delightful island of Martha's Vineyard, where the socially inclined may enjoy the advantages of summer schools of science, or participate in the exercises of the camp-meeting within spacious and airy pavilions. Here the artist finds a prospect of varied color, with long vistas of cliff and sea and sky standing forth in surpassing loveliness and inviting an effort to place on canvas his richest and brightest tints.

To the student of nature, however, there is access to an ever-increasing store of facts. The more he investigates the structure of the region, with its assemblage of creatures and plants, or views the struggles of atmosphere, land, and ocean to maintain an equilibrium, the more he finds himself beset by perplexing questions, which will not be answered at his bidding. A riddle, as yet but partly solved, lies involved in that wonderful piece of earthy structure called Gay Head. Here, at the western extremity of the island rests a huge pile of sand, rock, and clay, more than one hundred feet high, tinted with numerous vivid colors, which have been the wonder and delight of the voyager ever since the discovery of the country. The sparse settlement of the island has as yet produced but a short chapter of the history of its people; but the record of nature's changes and disturbances, which have affected the land and sea, would fill large volumes.

To one series of these changes, belonging to its geology, we would now direct attention. The greater part of the island shows evidences of having been submerged five times beneath the waters. At each emergence from the water, an increased thickness was given to the body of the land, so that at the beginning of the last glacial period it stood on the western side at a level of not less than two hundred feet above the surface of the tide.

At the close of that period and chiefly remaining to the present time, a deep deposit of fine sand, boulders, gravel, and broken stones, from ten to twenty-five feet in thickness, covered the upper slope of the ridge. The Potomac Clay, which forms the inner and also the lowest descending division of the deposits resting here, rises like a central core to near the summit of this hill. As most of the other members below the glacial deposits are either absent from, or only feebly represented on, the upper surface of the clay, a thin bed of sand and other glacial material forms the superficial covering. On both slopes of this ridge, the west and the east, the column of geological formations is present, although not in fully unbroken continuity, the Cretaceous Green-Sand Marl having not been found on the eastern slope by the

writer. On this side, however, the Raritan Formation, previously defined in Maryland as the Alternate Clay-Sand group, displays an exceedingly fine exposure, with the strata and laminated layers in original order. Here, also, it is enriched with the same plant fossils and lignitic wood so characteristic of these beds on the Raritan, Severn, Magothy, and other rivers of New Jersey and Maryland.

No evidences of mountain-folding appear in any part of the elevated division of the land. The underlying member which descends deep below tide, is the Variegated Potomac Clay, and this forms the foundation for all the other formations in their usual order of superposition.

Deep denudation and erosion followed the completion of the Potomac Clay, and it was cut to below the line of present low tide at the localities now occupied by Menemsha, Squibnocket and Nashaquitsa ponds. The broken surface of this clay and the presence of the Raritan and other beds above it on the low hills of Menemsha Bight, show how deeply the Potomac formation was here degraded before the next succeeding formation was laid down. Consequently in early Cretaceous time a high plateau of the clay was carved into sloping reliefs which had their most depressed surfaces spreading away towards the east and south.

The steep side of the island is on the west, and here it is that the modern surf has cut away large tracts of the ancient bluff. On the Gay Head division the sea has been digging away the cliffs at the rate, it is said, of sixteen to twenty feet in a year. The stretch of boulders called the Devil's Bridge, lying at a distance of fully half a mile from the present beach, shows where the outer border of the bluff formerly stood. The Potomac Clay not only extends out that far at the bottom of this shallow shelf of Vineyard Sound, but we are told that it sticks to the anchor in the channel which now runs on a course more than two miles distant from the present beach. A searching survey ought to show that this clay underlies the Elizabeth Islands and stretching away south-west passes under the borders of the mainland of Massachusetts and Rhode Island, and from thence under Long Island and Staten Island to beneath the lower clays of New Jersey.

The section as it is now exposed in the less-disturbed bluffs of Gay Head shows the Variegated Clay near the beach in strata or arched beds from three to more than ninety feet in thickness. The undisturbed upper part of this member is sometimes a whitish or red clay, and is often more or less mixed with sand.

Immediately above this, but not on the summit of the clay, rests the group for which we now offer the name Raritan Formation, from the river on the shores of which it is so extensively exposed. It consists of a few feet of brown, coarse sand at base, which is sometimes indurated into a moderately coherent sandstone. Above this is a bed, two or three feet thick, of white sand locally streaked with white clay. Over this the laminated sands, black and gray, charged with lignite, and parted with fine white sand, rise up into thin layers of a paler clay which alternates with seams of the white sand. This clay appears more massive in some sections of the bluffs, and occasionally forms a homogeneous stratum, from three to five feet thick. Next above this is a most conspicuous stratum of disintegrated granite, which is a kind of coarse rock-flour, white on the weathered surface, but gray in the covered mass. It forms a bed ranging from ten to more than fifteen feet in thickness. This forms the superior member of the group, while the whole Raritan Formation, as here recognized, reaches a maximum thickness of about fifty feet.

Next higher in the bluffs rest the ferruginated remnants of the Cretaceous Green-Sand Marl. The great body of this deposit has slipped down or been overthrown upon the steep side of the cliff facing Vineyard Sound. It appears in three separate piles, stretching from near the summit of the projecting buttresses down to the beach. The only part of it now remaining near the line of its original position is represented by a few inches of altered brown sand, in patches. These are the vestiges of the thin edge of the stratum which stretched out towards the sound, and which terminated in a bed eight to ten feet thick in modern time. Eighty or more feet outwards it is a thick body of dark-green

¹ A Treatise on Heraldry: British and Foreign. By John Woodward, F.S.A., and the late George Burnett, LL.D. (Lyon King at Arms). W. & K. Johnston, Edinburgh, 1891.

sand, resting in one place on end, and much mixed on the surface, sides, and end with gravel and fossils belonging to later formations. Bones of whales and fragments of shells of the Miocene Formation have settled into its broken surface; but in the unmixed interior of the mass, it has yielded to me soft casts of *Gryphea* and *Cucullea*, hard fragments of the bones of reptiles, with coprolites, and teeth of the shark *Otodus*. The component materials of this marl agree with those of the Lower Marl of New Jersey, and, like the latter, rest directly upon the upper member of the Rapitan Formation.

The Miocene Formation, so far as my own observation extended, is broken up, and so mixed with the drift at the base of the glacial deposits near the surface that the only evidence of its former presence here, below the belt of conglomerate, resides in the presence of vertebræ of Cetacea, fossil shells, and some teeth of sharks.

On the surface is the fine pale sand, forming a loose bed, underlain by about two feet of pebbly conglomerate which rests in a bed of broken rocks, gravel, and boulders. The sand is spread thickly over most parts of the island, and along the western ridge it is set with granitic boulders measuring occasionally twelve feet in length and width by six to eight feet in thickness.

The whole Gay Head promontory is a scene of disturbed equilibrium, where the beds of rock-derived material have been softened by atmospheric agencies, pressed down by a load of stone and gravel, undermined by oceanic strokes of oceanic surf, and let down into gullies by trenching storms of rain.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

A Mountain-Top Experience.

FREMONT PASS, Colorado, is 11,540 feet above the sea. To the east rises a peak by a rather steep slope, perhaps 2,000 feet higher. Its eastern slope is precipitous.

On Aug. 18, alone, I reached the summit of this peak. It was noon. Several miles away to the north a heavy thunder-storm was raging, while far to the west was another. Within a mile or two a massive cloud had formed between the lower mountains which shut in a gorge. I stepped to the very highest point of the peak. My contemplation of the extraordinary view afforded me was disturbed by a sharp buzzing as of bees seemingly beneath my hand which rested on the bulky pine sliver serving as my staff. But on lifting my hand I found no bees large or small.

As the buzzing continued, I vainly scrutinized the stick for signs of life. I then indifferently concluded that it was possibly caused by some boring insect in the wood. That settled (?), I lifted a large roundish rock to toss into the chasm below, when it, too, buzzed or crackled in my hand at a score of points. Close inspection revealed no bees or bugs on that rock. Can it be. I asked, that this rock is crackling from the change of temperature occasioned by a change of position? At that moment, the "bees" were swarming in my hat. Snatching it off, I was searching it for the buzzing things when they seemed to throng my hair. Immediately on raising my hand to my head the puzzling mystery was solved, as the strong flow of electricity fairly tingled and buzzed through my fingers, and, looking up, I saw a cloud forming overhead. I was acting as a lightning-rod to that mountain-peak. Ignorant of my possible safety or danger in the involuntary experiment, I lacked the valor or scientific devotion to prolong it. Securing my box of flowers and that buzzing staff, I discreetly retired some distance down the slope from that summit surcharged with possible electrocution if I remained. Ere I reached the pass, two hours later, the storm from the north had reached the peak, and soon that rocky summit was whitened with snow, while hail and rain fell in the pass.

During my descent, while the thunder-cloud rapidly approached the peak, a strong wind blew through the pass directly toward

the cloud until light rain began to fall. Is my experience as given a common one? Was it a dangerous one?

O. C. CHARLTON.

Denton, Texas.

The Gemination of the Lines in Mars.

As far as one can judge from newspaper reports, the recent observations on Mars render certain the existence of the curious Schiaparelli lines, but as yet nothing has been seen of the doubling, or gemination, which has been claimed. If this negative result shall be sustained by the accounts yet to come from observatories in lower latitudes, there still remains the interesting question, How did such a mistake come to be made?

A bit of personal experience will, I trust, be pardoned, since it points to what seems to me the explanation of the error, if one exists; at least, it shows the existence of a *vera causa* able from single lines to produce double ones. The lens in my left eye possesses the power of double refraction. If I close the right eye and

look at a line drawn obliquely, thus  the paper being held

No. 1.

squarely in front of me, I see nothing peculiar; there is to me, as to anyone else, only one ordinary black line. But if the line

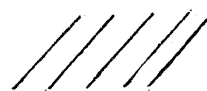
slopes thus  I see two lines  the lower one being

No. 2.

No. 3.

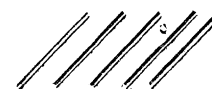
decidedly less deeply black than the other. As I now hold the paper, the bottom towards me, No. 1 appears as a single line, No. 2 as a double one, like No. 3. If now I turn the side of the page towards me, revolving it through an arc of 90°, No. 1 shows double and No. 2 single.

If I draw a set of single lines as below



No. 4.

and look at them with both eyes, or with my right eye alone, I see only so many single lines; but if I close my right eye, then with my left I see ten lines, each original line being geminated by a fainter one exactly parallel, and pretty close to it, as in No. 5.



No. 5.

If now I turn No. 4 to the right or left, the double images will approach each other, and at the same time slide by each other a little until I have turned the paper 90°, when the images will coalesce, each line appearing sharply defined, single, and very black, except at each end, where for about $\frac{1}{16}$ of an inch the color will be fainter and the line less sharply defined. I can vary my experiments in many ways, each time getting the well-known phenomena of double refraction.

The application to the lines in Mars is very simple. If a person possessing an eye with this power should see the planet's image in the telescope, and be able to perceive the Schiaparelli lines, he would see each accompanied by a twin line of the same length, but not quite so sharp and distinct. If the lines ran, as in No. 1, from north-west to south-east, he would not see the secondary ones, but if his other eye chanced also to have a double refracting lens with axis at right angles to the first, he would then see the secondary lines in the same way.

I know, from my own experience, that one may possess this power without being conscious of it. I discovered it only when experimenting on single vision. In ordinary use (i. e., with both eyes) I cannot perceive any indication of it, the greater illuminating power of the ordinary ray, plus that of my other eye, com-

pletely conceals the secondary image. I have no doubt that if I should look at Mars through an instrument powerful enough to show the single black lines, I should rediscover the twin line of each, that is, if I used the polarizing eye.

I presume others have noticed this power in themselves, or discovered it in other persons, but I have not happened to come across such. One can easily test his own eyes, by making a fine black dot on a piece of white paper and examining it with one eye at a time. If he possesses this power, he will see two dots pretty close together, one much darker than the other. Then let him revolve the paper; the paper will go around, but the dots will retain their relative position. If, for example, the secondary dot is to the right of the other, it will stay to the right, however much the paper is turned. It may be necessary to move the paper nearer to or farther from the eye, but if the double-refractive power is there, it will soon be found. C. B. WARRING.

Park Lupin, Aug. 29.

The Aurora of July 16.

THE various accounts of this aurora which have come to my notice contain no mention of a band or curtain formation. They all agree in describing the aurora as simply an arc of light, with well-marked streamers of more or less brilliant coloring. I append a description of an appearance, not already noted, which was observed by me in Mechanicsburg, Pennsylvania.

The day had been cool and fair, and after sunset only a few clouds could be seen in the north. About nine o'clock a faint auroral arc was visible, and later a brilliant white ray shot out from the north-west and extended beyond the zenith. Nothing more of note occurred for an hour. By this time the clouds had disappeared, with the exception of two small stratified bands, which hung low in the north. They were parallel with a narrow opening in line with the horizon. At 10.15 this space became brilliantly lighted, the color changing between green and pink. Then from the eastern edge of the space a brighter and intensely green light spread rapidly westward, and apparently descended from between the clouds, assuming the shape of a band in folds or waves like a banner in a breeze, as those who have seen this appearance in more northerly latitudes describe it. When the band became well defined, it grew stationary and the green light increased in intensity; and then occurred a magnificent electrical display. From the upper edge a bright pink light suffused downwards until it almost overspread the curtain, when it paused; and for a few seconds there was presented a pink banner, edged with a regular but narrow border of bright green, in stationary folds or waves. Yet there was no progressive wave-motion observed, as seems common to this phenomenon. The formation was repeated after a time, but very indistinctly. As nearly as could be estimated, the entire occurrence could not have lasted more than ten seconds.

W. M. STINE.

Athens, Ohio.

The Ancient Libyan Alphabet.

IN *Science*, Aug. 19, Dr. Brinton treats my equation of *Finagh* with *Phœnician* as "fanciful," and traverses my assertion that the stress falls on the root *fin*. The equation may be fanciful, but the assertion, stigmatized as "utterly incorrect," is absolutely true. Dr. Brinton says that the stress "falls on the last syllable, and not on the penult (see Hanoteau, 'Grammaire Tamachek,' p. 5)." From this the reader might suppose that the French scholar was on Dr. Brinton's side, and accented the word on the last syllable. Such is not the case. Hanoteau does not accent the word at all, makes no remark on its accentuation, and in his grammar nowhere refers to the question of accent. It is Barth, a supreme authority on a point of this nature, who always accents the word on the penult, as already stated by me. What Dr. Brinton appears to have mistaken for an accent in Hanoteau (p. 5) is not an accent, but a diacritical mark used by him to distinguish the "r grasseyé" answering to the Arabic *ghain* from the soft *r* (*r'* and *r*), and in the same way to distinguish the deep guttural *k* (*q*) answering to the Arabic *qof* from the ordinary *k* (*k'* and *k*). Hence he writes *tifinar'*, the mark falling, not on the final vowel *a*, but on the final consonant *r*, which he means to be pronounced

as with the Northumbrian *burr*, or like the Arabic *ghain* (tiffinagh, as Barth always writes it, and always accenting the *i* of *fin*, thus, tiffinagh).

It is strange that Dr. Brinton should have at all ventured to take up my reference to Hanoteau, for on the main issue Hanoteau is dead against him, writing that "le système d'écriture des Imouchar' [Sahara Berbers] est analogue à celui des Arabes et des Hébreux" (p. 1). In other words, it is Semitic. But doubtless the passage has escaped Dr. Brinton's notice. As to Dr. Collignon's cock-sure assertion that it is "antérieure à Carthage" and that "it is time to discard" the theory of its Punic origin, it will suffice to say that, if it comes to the *ipse dixit* argument, the name of Mommsen alone will outweigh fifty thousand Collignons.

Lastly, touching the squares and the rounds, otherwise a point of secondary importance, unless you have a theory to serve, my reference should rather have been to Hanoteau's "Grammaire Kabyle" than to his "Grammaire Tamachek." It is in the former work (p. 360) that is given the full table of the three variant Berber alphabets, with the following results: I. Five curves; six rectangular forms; two acute angles. II. Seven curves; five rectangles; two acutes. III. Six curves; five rectangles; three acutes.

And here the matter may rest, as Professor Newman needs no rehabilitation from me, and in any case cannot be held responsible for the incapacity of "French scholars" to assimilate his "phonetic system."

A. H. KEANE.

79 Broadhurst Gardens, South Hamstead, N.W., Sept. 7.

BOOK-REVIEWS.

Life Histories of North American Birds, with Special Reference to Their Breeding Habits and Eggs. By CHARLES BENDIRE. Washington, Government. 554 p. 4°. III.

The Humming Birds. By ROBERT RIDGWAY. Washington, Government. 131 p. 8°. III.

THE publications of the Smithsonian Institution and of its offspring, the U. S. National Museum and the Bureau of Ethnology, are becoming almost too numerous to be kept track of by any but the professional librarian. Ordinary readers have long since despaired of the task, and consider it as a matter of course that they will seldom or never hear of them all, to say nothing of the pleasure of seeing them. True, many of these publications are of such technical character that only specialists care for them, and these are supposed to be cognizant of the publications pertaining to their study. On the other hand, there are many papers published by the Institution of great general interest, and it frequently happens that these are largely inaccessible to the general public. Any retrospective view of the work of the Smithsonian from its inception deals almost exclusively with its publications. These beginning with meagre annual reports, containing administrative and financial statements, have increased so in numbers and variety that it requires a good-sized volume to catalogue them. It is the intention here to refer to them in only the most general way.

At the present time they may be grouped under three heads: 1. Those of the Smithsonian proper; 2. those of the U. S. National Museum; and 3, those of the Bureau of Ethnology. Under the first of these we have (a) annual reports; (b) miscellaneous collections; (c) contributions to knowledge. Under the second we have (a) annual reports; (b) proceedings; (c) bulletins; and (d) special bulletins. Under the third come (a) annual reports; (b) contributions to North American ethnology.

To still further complicate matters and bewilder the enquirer, we find that frequently there are several editions of these volumes, one always appearing in the guise of a congressional document, and another in the form designed for general distribution. Besides this, it has of late become the habit, perhaps from the necessities of the case, to issue, under a separate cover, papers which may appear in various annual reports or proceedings.

The first few annual reports of the Board of Regents of the Smithsonian contain few or no papers of any great general interest. It was not many years, however, before these began to appear in an appendix to the administrative report. During the latter part of Professor Baird's administration a special feature

was made of general summaries of the progress of science. Within the past few years these have been discontinued, and there is a return to the old plan of placing in an appendix papers having special value. Further, since the National Museum has fairly begun its work, the annual report has been swelled far beyond the compass of one, and so is now issued in two volumes. One of these is devoted to the Smithsonian, and the other to the Museum. The annual reports and other publications of the Bureau of Ethnology will not be considered here.

The second series of publications of the Smithsonian is the "Miscellaneous Collections." In this are given papers which are the results of original investigation, and which are too long to be included in the annual reports. The volumes are in octavo form, and some of them, like Gray's "Synoptical Flora of North America," contain from 900 to 1,000 pages. There are now about 35 volumes in this series. The third series, "Contributions to Knowledge," is in quarto form, and includes many elaborate and finely illustrated monographs. Among them are Squier and Davis's "Ancient Monuments of the Mississippi Valley," Wood's "Fresh-Water Algæ," etc. There are about 25 volumes in this series.

Of the publications relating to the work of the U. S. National Museum, the annual reports have already been referred to. Papers in these admit of considerable elaboration, but are not considered extensive enough to be published in separate form except as excerpts, which is the case with the second of the books given in our title. When it became apparent that the results of the work of the curators of the Museum would be too long delayed if issued in the annual reports, the "Proceedings" of the Museum was established. This contains advance notices of work, with preliminary descriptions and short notes, which could find no place in other series of the Institution. It is now in its fifteenth volume, but it is published in so small an edition that it is only rarely seen outside of public libraries. Excerpts from it, however, are frequently distributed to specialists. In 1875, previous to the establishment of the "Proceedings," there began to appear a series under the name of "Bulletins." These are octavo in form, and consist of long and elaborate monographs of various orders, or catalogues of birds, beasts, or plants. There are now some 39 of these Bulletins.

Finally, a new series of "Special Bulletins" in quarto form has been begun. Of this series, the volume which forms the first portion of our title is No. 1. The author, Capt. Bendire, is the curator of oölogy in the museum, and he gives in the volume descriptions of the breeding habits of gallinaceous birds, (partridges, grouse, etc.), pigeons, doves, and birds of prey. The nomenclature followed is that of the American Ornithologists' Union Check-list. There is no attempt at synonymy, only the original and the latest name being given. The geographical range for each is also given. In the text there is no description of the bird itself, but the breeding habits, food, nest, and eggs are all fully described. This information has been derived from original notes, from private correspondence, and from published statements. Many interesting facts are given, and a few extracts will serve to show the rich store it contains. The following account of the dance of the prairie sharp-tailed grouse of Manitoba is quoted from the unpublished notes of Mr. E. E. Thompson:—

"After the disappearance of the snow, and the coming of warm weather, the chickens meet every morning at gray dawn, in companies of from six to twenty, on some selected hillock or knoll, and indulge in what is called a 'dance.' This performance I have often watched, and it presents the most amusing spectacle I have yet witnessed in bird life. At first the birds may be seen standing about in ordinary attitudes, when suddenly one of them lowers its head, spreads out its wings nearly horizontally and its tail perpendicularly, distends its air-sacs, and erects its feathers, then rushes across the 'floor,' taking the shortest of steps, but stamping its feet so hard and rapidly that the sound is like that of a kettle-drum; at the same time it utters a sort of bubbling crow, which seems to come from the air-sacs, beats the air with its wings and vibrates its tail, so that it produces a loud, rustling noise, and thus contrives at once to make as extraordinary a spectacle of itself as possible. As soon as one commences, all join in, rattling, stamp-

ing, drumming, crowing, and dancing together furiously; louder and louder the noise, faster and faster the dance becomes, until at last, as they madly whirl about, the birds leap over each other in their excitement. After a brief spell the energy of the dancers begins to abate, and shortly afterward they cease, and stand or move about very quietly, until they are again started by one of their number leading off. . . . The space occupied by the dancers is from 50 to 100 feet across, and, as it is returned to year after year, the grass is usually worn off, and the ground trampled down hard and smooth. The 'dancing' is indulged in at any time of the morning or evening in May, but it is usually at its height before sunrise. . . . When the birds are disturbed on the hill, they immediately take wing and scatter, uttering as they rise their ordinary alarm note, a peculiar vibrating 'cack, cack, cack.' This is almost always uttered simultaneously with the beating of the wings, and so rarely, except under these circumstances, that at first I supposed it was caused by the wings alone, but since then I have heard the sound both when the birds were sailing and when they were on the ground, besides seeing them fly off silently."

One of the dangers of egg-hunting in the western wilds is given in an account of the zone-tailed hawk. One day, while riding up Rillitto Creek, in Arizona, Capt. Bendire observed one of these birds fly from its nest, and he determined to examine it. "Climbing to the nest," he says, "I found another egg, and at the same instant saw from my elevated position something else which could not have been observed from the ground, namely, several Apache Indians crouched down on the side of a little cañon which opened into a creek bed about eighty yards further up. They were evidently watching me, their heads being raised just to a level with the top of the cañon. In those days (1872) Apache Indians were not the most desirable neighbors, especially when one was up a tree and unarmed. I therefore descended as leisurely as possible, knowing that if I showed any especial haste in getting down they would suspect me of having seen them; the egg I had placed in my mouth as the quickest and safest way that I could think of disposing of it,—and rather an uncomfortably large mouthful it was, too,—nevertheless, I reached the ground safely, and, with my horse and shot-gun, lost no time in getting to high and open ground. . . . I found it no easy matter to remove the egg from my mouth without injury, but I finally succeeded, though my jaws ached for some time afterward."

The author puts in a number of good words for the much-abused owls, considering that, as a rule, they are more useful to the farmer and poultry-raiser than harmful. This is especially the case with the barn owl, barred owl, screech owl, and burrowing owl. The great horned owl, on the contrary, is destructive, and merits the condemnation generally accorded it. Domestic fowls and game birds are killed by it in quantities, besides which it feeds upon various mammals, such as rabbits, squirrels, skunks, muskrats, etc. The account given of the burrowing owl disposes of the story that the bird lives in harmony with the prairie-dog and the rattlesnake, and the following extracts are thought to be of interest sufficient to quote:—

"A good deal of nonsense has found its way into print about the life-history of this owl; and the sentimental story of its living in perfect harmony with prairie-dogs and rattlesnakes, both of which inhabit a considerable portion of the range occupied by these owls, was for years accepted as true, and furnished the ground-work for many an interesting tale. . . . From an extended acquaintance with the habits of the burrowing owl, lasting through a number of years' service in the West, I can most positively assert, from personal experience and investigation, that there is no foundation based on actual facts for these stories, and that no such happy families exist in reality. I am fully convinced that the burrowing owl, small as it is, is more than a match for the average prairie-dog, and the rattlesnake as well; it is by no means the peaceful and spiritless bird that it is generally believed to be, and it subsists, to some extent, at least, on the young dogs, if not also on the old ones.

"In Washington, Idaho, and Oregon they appear to migrate about the beginning of November, and sometimes earlier, returning to their summer homes in the early part of March. At any

rate, without actually examining their burrows during the winter months to ascertain their presence, I never saw one of these birds, as far as I can remember, sitting in front of these at such times, and I have lived where they were very common, and would certainly have noticed one occasionally if actually about. . . . These birds are diurnal in their habits, and may be seen sitting in front of their burrows at any hour of the day. When not unduly molested, they are not at all shy, and usually allow one to approach them near enough to observe their curious antics. Their long slender legs give them rather a comical look, a sort of top-heavy appearance, and they are proverbially polite, being sure to bow to you as you pass by. Should you circle around them, they will keep you constantly in view, and, if this is kept up, it sometimes seems as if they were in danger of twisting their heads off in attempting to keep you in sight. If you venture too close, they will rise and fly a short distance, and generally settle down near the mouth of another burrow close by, uttering at the same time a chattering sort of note, and repeat the bowing performance. Occasionally, when disturbed, they alight on a small sage bush, probably to get a better view of the surroundings.

"They hunt their prey mostly in the early evening and throughout the night, more rarely during the day-time. As soon as the sun goes down they become exceedingly active, and especially so during the breeding season. At such times they are always busy hunting food, and go and come constantly, and they may often be seen hovering suspended in the air, like the sparrow-hawk, locating their prey, or darting down noiselessly and swiftly, and grasping it with their talons without arresting their flight an instant. The actual amount of food a pair of these birds require to bring up their numerous family, generally averaging eight or nine, is something enormous. Each owl will eat fully its own weight in twenty-four hours, if it can get it. . . . As nearly all the food used by them consists of noxious vermin, it readily appears what an immensely beneficial bird the burrowing owl is, considered from an economic point of view, and deserving of the fullest protection.

"In southern California the burrowing owl commences laying about the beginning of April; in Oregon, Washington, and Idaho, rarely before the fifteenth of the month, and usually about the latter part of it; in Kansas and northern Texas, it begins about the same time; in Utah, fresh eggs have been found as late as June 15, and at Fort Collins, Colorado, on July 1.

"Although incubation does not appear to begin until the clutch is nearly completed, I have always found one of the parents at home, even if there was but a single egg in the nest. The old bird is courageous in the defence of its domicile, and, as a rule, will not leave it, although the way may be left clear for it to do so. Backing up to the extreme end of its burrow, it will strike with beak and claws in defence of its nest. Frequently, when within a foot or two of the nest proper, and before it was yet visible, the occupant made a rattling noise, produced by the rapid movement of its mandibles, which sounded very much like the warning of the rattlesnake when disturbed; this would easily impose on the average investigator, and, proceeding out of the burrow somewhat muffled and subdued, it is very similar indeed to the rattle of the latter."

There are 146 species described in the volume. Illustrations of the eggs of 94 of these are given on 12 beautifully colored lithographic plates. In looking over them, it is noticeable that, while the eggs of game birds and birds of prey are variously speckled and mottled, those of doves, pigeons, and owls are uniformly white. The last generally nest in holes in trees or similar places and are not conspicuous by reason of this color. The eggs of doves and pigeons, while placed in open nests, are screened by the parent birds, which are protectively colored. Grouse and other game birds generally lay their eggs on the ground, where their mottling prevents their being conspicuous; white birds of prey have similarly marked eggs, which may be considered as protectively colored also. The book contains a great mass of interesting information which will be welcomed both by ornithologists and the ordinary lover of birds. One cannot but regret that the index

Publications Received at Editor's Office.

- CANADIAN GEOLOGICAL SURVEY. Annual Report for 1888-89. Ottawa: S. E. Dawson. 8°. Paper.
 COMMISSIONER OF FISH AND FISHERIES. Report on the Establishment of Fish-cultural Stations. Washington: Government. 4°. Paper. 88 p. Ill.
 HAY, O. P. On the Breeding Habits, Eggs and Young of Certain Snakes. Washington: Government. 8°. Paper. 13 p.
 — On the Ejection of Blood from the Eyes of Horned Toads. Washington: Government. 8°. Paper. 9 p.
 HOWARD, L. O. Insects of the Sub family Eneyrinae with Branched Antennae. Washington: Government. 8°. Paper. 9 p.
 STEJNEGER, LEONHARD. Two Additions to the Japanese Avifauna. Washington: Government. 8°. Paper. 3 p.
 TORREY, BRADFORD. The Foot-Path Way. Boston: Houghton, Mifflin & Co. 12°. 245 p. \$1.25.
 U. S. NAVAL OBSERVATORY. Meteorological Observations and Results, 1888. Washington: Government. 4°. Paper. 60 p.
 — Magnetic Observations, 1891. Washington: Government. 4°. Paper. 100 p.

Reading Matter Notices.

Ripans Tabules: best liver tonic.
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For Sale.—About 1087 volumes of the private library of Dr. Nicolas León, formerly director of the Museum at Morelia, embracing publications of special value for Mexicologists, like those of Bishop Zumárraga (16th century), of Sigüenza y Gongora, of Aleman, etc., the Missal of Spinoza, all very scarce; manuscripts on the history of Michoacán and other Mexican States, on the Tarasco (the Indian language of Michoacán) and several works, of which the only copy known to exist is in this collection. Parties interested in the sale please address Dr. NIC. LEÓN, Portal de Matamoras, Morelia, Mexico.

INDEXES

TO

Volumes XVII. and XVIII.

OF

SCIENCE

are in preparation, and will be issued at an early date.

Wants.

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is so defective. The authorities quoted from or referred to are frequently mentioned, but there are innumerable cases where they are not. It thus becomes an impossibility to ascertain from the index whose work has been and whose has not been referred to.

The second title mentioned in our heading pertains to a paper of quite a different character from the foregoing. The first is a bulletin in itself, the second is an excerpt from the annual report of the U. S. National Museum for 1890: the one treats of special features in the life of birds, the other discusses in general and particular the characters of a small group. In this monograph on humming birds the author, Mr. Robert Ridgway, gives an interesting account of these wonderful little creatures. Among the many subjects discussed, we find an account of the early history of the literature of the group; remarks on the geographical distribution of the species; mention of their habits, manner of flight, migrations, intelligence, nests and eggs, food, variations, etc. The last 70 pages are devoted to descriptions of the species occurring in the United States, seventeen in all, of which illustrations are given of all but five. There are many other figures, some of which are original and others copied from Gould's "Monograph of the Trochilidae."

The family is essentially one of the New World, not a single species being known outside of its bounds. Their diminutive size and brilliant coloration have made them favorites with ornithologists, and, as in the case of every other well-studied group, innumerable genera and species have been made. Dr. Coues refers to this fact, and notices that it was carried to such length that it finally reached "the farcical and scandalous extreme of some 350 genera for few more than 400 known species." In size the species vary from about $8\frac{1}{2}$ inches long to only $2\frac{1}{2}$ inches. Notwithstanding their smallness, they are capable of the most rapid flight, and some perform journeys of 2,000 miles in their semi-annual migrations. On the west coast the highest latitude attained is in Alaska, about 61° , by the rufous-backed hummer, which is found

in winter in Mexico, more than 2,000 miles to the southward of its summer station. In the eastern United States the common ruby-throat ranges in summer as far north as 57° , and in winter is not known to occur north of southern Florida (latitude 29°), while its most southern limit is on the Isthmus of Panama, only 8° north of the equator. Species are most numerous in mountainous countries where there is great diversity of soil and productions within small areas. The State of Ecuador has 100 species within its borders, more than one-half not occurring elsewhere. Mr. Ridgway says regarding their geographical distribution: "Their centre of abundance is among the northern Andes, between the parallels of 10° north and south of the equator, from which region they gradually diminish in numbers both to the northward and southward, but much more rapidly toward the extensive lowlands of the eastern portion of the continent. The northern limit of their abundance may be approximately given as the Tropic of Cancer, beyond which but few of the fifty Mexican species extend, while only eighteen of them have been detected across the boundary line in the equally mountainous portions of the south-western United States, including the semi-tropical Rio Grande Valley. Small as this number may appear, the south-western portion of the Union may be considered richly endowed compared with the vast valley of the Mississippi and the Atlantic water-shed, a region of unsurpassed fertility and luxuriant vegetation, yet which throughout its whole extent, even including the peninsula of Florida, possesses only a single species of humming bird!"

The usefulness of this monograph would be greatly increased by the addition of a table of contents and an index. Neither of these is present in the excerpt, a though they are probably provided for in the report from which it is taken. One must turn page after page to find remarks upon any special subject. Notwithstanding this, however, readers must be grateful to Mr. Ridgway for the work he has done.

JOSEPH F. JAMES.

Washington, D.C., Sept. 16.

Dyspepsia

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